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FLOOD INSURANCE STUDY

CITY OF HEMPSTEAD, TEXAS
WALLER COUNTY

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DECEMBER 15, 1980

federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 481045

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TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	Purpose of Study	1
1.2	Authority and Acknowledgments	1
1.3	Coordination	1
2.0	AREA STUDIED	2
2.1	Scope of Study	2
2.2	Community Description	2
2.3	Principal Flood Problems	4
2.4	Flood Protection Measures	4
3.0	ENGINEERING METHODS	4
3.1	Hydrologic Analyses	5
3.2	Hydraulic Analyses	5
4.0	FLOOD PLAIN MANAGEMENT APPLICATIONS	6
4.1	Flood Boundaries	6
4.2	Floodways	7
5.0	INSURANCE APPLICATION	9
5.1	Reach Determinations	10
5.2	Flood Hazard Factors	10
5.3	Flood Insurance Zones	10
5.4	Flood Insurance Rate Map Description	11

TABLE OF CONTENTS - continued

		Page
6.0	OTHER STUDIES	11
7.0	LOCATION OF DATA	11
8.0	BIBLIOGRAPHY AND REFERENCES	11

FIGURES

Figure 1 - Vicinity Map	3
Figure 2 - Floodway Schematic	9

TABLES

Table 1 - Summary of Discharges	5
Table 2 - Floodway Data	8
Table 3 - Flood Insurance Zone Data	12

EXHIBITS

Exhibit 1 - Flood Profiles Blasingame Creek	Panels 01P-03P
Exhibit 2 - Flood Boundary and Floodway Map	

PUBLISHED SEPARATELY

Flood Insurance Rate Map

FLOOD INSURANCE STUDY
CITY OF HEMPSTEAD, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Hempstead, Waller County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the City of Hempstead to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Espey, Huston and Associates, Inc., for the Federal Insurance Administration, under Contract No. H-4569. This study was completed in March 1980.

1.3 Coordination

A meeting held at the City of Hempstead on June 6, 1978, was attended by officials of Hempstead, a representative of the FIA, and a representative of Espey, Huston and Associates, Inc. The meeting was held to explain the nature and purpose of the study, the scope and limits of the work, and to obtain any available flood information relevant to the study.

A subsequent meeting was held on March 12, 1980, with the Mayor of Hempstead and the Waller County Flood Plain Administrator. The results of the study were reviewed and additional information concerning flooding in the com-

munity was obtained.

On July 28, 1980, the results of the study were reviewed at the final meeting attended by representatives of the study contractor, FIA, and community officials. The study was acceptable to the community.

The U.S. Geological Survey (USGS) district office in Houston was contacted on the availability of stream gaging stations within the study area. It was found that Waller County had only one gaging station located on the Brazos River near Hempstead.

The following agencies were contacted in order to obtain flood information for Hempstead:

> U.S. Army Corps of Engineers, (COE) Hydrology Division, Galveston, Texas; Soil Conservation Service (SCS) in Hempstead and Temple, Texas; The Waller County Flood Administrator in Hempstead, Texas; the City of Hempstead; the Water Resources Division of the Geologic Survey; and the Texas Department of Water Resources (TDWR) in Austin, Texas.

No Flood data applicable to the study area were found.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Hempstead, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through March 1985.

2.2 Community Description

Hempstead, Texas, is located in the central portion of Waller County. The city is approximately 50 miles northwest of Houston and covers an area of approximately 3.8 square miles. U.S. Highway 290, State Highway 6, State Highway 159, and the Southern Pacific Railroad pass through the center of the city.

Hempstead, which was incorporated in 1871, has an agricultural, manufacturing, and business-related economy. Principal agricultural products include corn, peanuts, cotton, vegetables, and watermelons. Located in the city is a manufacturer of women's clothing and a manufacturer of aniline dye

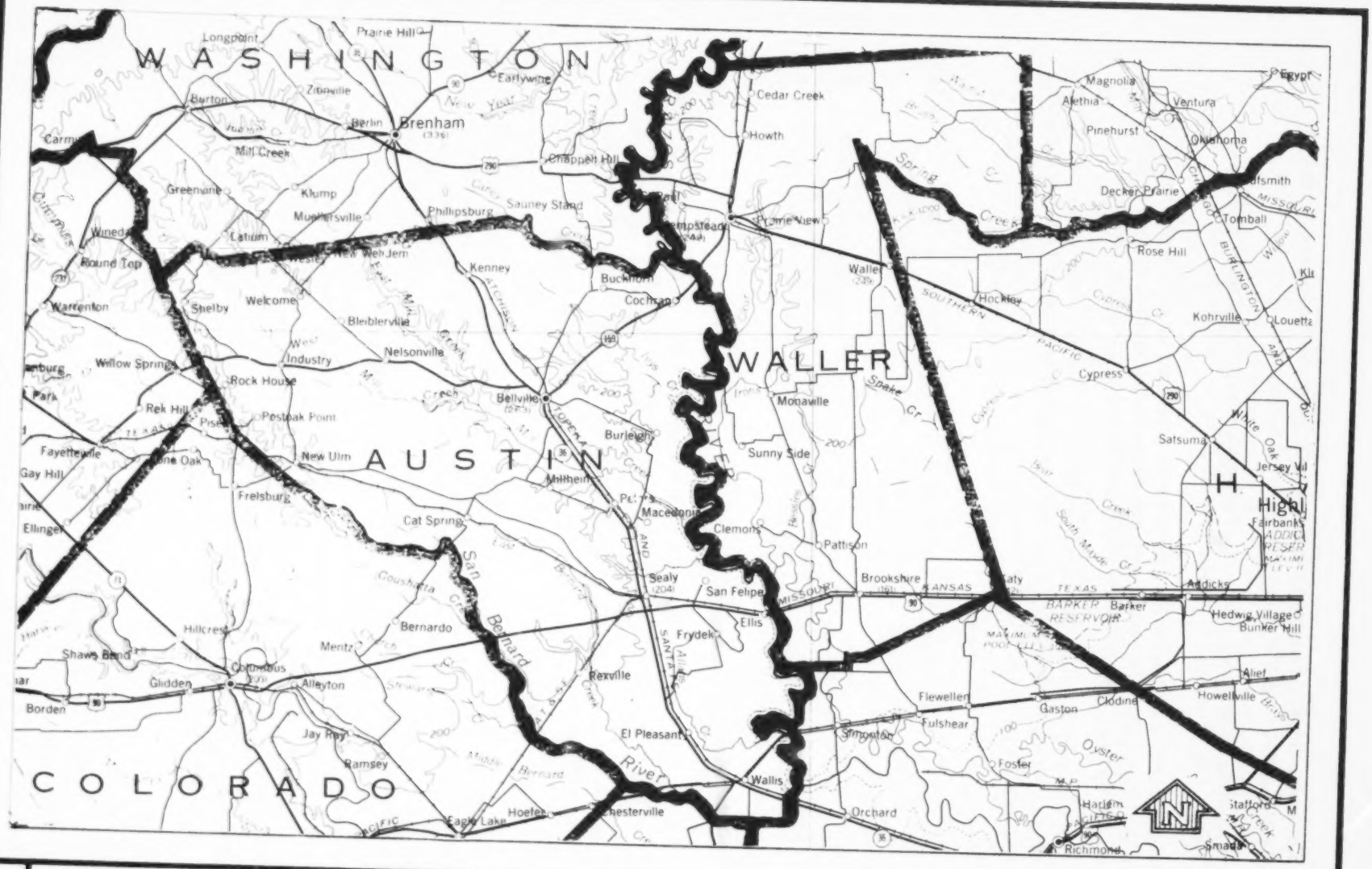


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF HEMPSTEAD, TX

(WALLER CO.)

APPROXIMATE SCALE

0 8 16 24 MILES

VICINITY MAP

pigments. Several businesses are also located along the highways passing through the city (References 1 and 2).

According to the Census Bureau, the population in Hempstead in 1970 was 1,891. The 1978 population was estimated to be 2,233 (Reference 3).

Hempstead has a temperate climate characterized by mild winters and warm summers. The annual average mean temperature is approximately 69 degrees F; average annual precipitation is 43 inches (Reference 4).

The topography within the corporate limits is characterized by gently rolling hills. The elevation ranges from 169 feet to 252 feet above National Geodetic Vertical Datum of 1929 (NGVD).

2.3 Principal Flood Problems

Most of the area within the corporate limits of Hempstead drains into Blasingame Creek. The southeastern part of the city, which is largely undeveloped, drains into a tributary of Clear Creek.

Flood problems exist in the areas that are adjacent to Blasingame Creek. However, the majority of Hempstead lies outside the 100-year frequency flood plain of Blasingame Creek and all the city is outside the 100-year frequency flood plain of Clear Creek.

2.4 Flood Protection Measures

A system of drainage ditches and storm sewers exists in the city to alleviate flooding in the developed areas. The storm sewer system in the central portion of the city routes drainage from the east side of the Southern Pacific Railroad to the west side of the railroad and into a tributary of Blasingame Creek (Reference 5).

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one percent

chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Flood discharges for Blasingame Creek were calculated using the method presented in USGS open-file report 77-54, "Techniques for Estimating Flood Discharges in Oklahoma Streams" (Reference 6).

This method is based on a regression analysis and requires three variables, channel slope, drainage area and mean annual precipitation in the calculation of flood discharges for rural streams. For urban streams (streams that have watersheds which are more than ten percent developed) two additional variables are needed. These variables are the percentage of the watershed area which is impervious and serviced by storm sewers. The Blasingame Creek watershed is classified as urban, thus all five variables are needed in the computation of flood discharges.

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
Blasingame Creek					
At St. Mary's Street	0.68	598	899	1042	1385
At Rice Street	0.89	716	1081	1256	1671
At Washington Street	1.53	1032	1569	1829	2450

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the City of Hempstead were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the flood sources.

All the natural ground and bridge cross sections used in the backwater analysis for Blasingame Creek were obtained from field surveys. These data were supplemented with information from USGS topographic maps (Reference 7).

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Since there are no stream gages within the study area, calibration of Manning's "n" values was not possible. The channel roughness coefficients (Manning's "n") used in the hydraulic computations were determined by engineering judgement and were based on field inspections of the streams and flood plains at each cross section. The roughness coefficent utilized for the main channel of Blasingame Creek was 0.055 and the roughness coefficient used for the flood plain was 0.09. Culvert and conduit roughness coefficients ranged from 0.015 to 0.026.

Water-surface elevations for floods of the selected recurrence intervals were computed through the use of the COE HEC-2 Water-Surface Profile computer program (Reference 8). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Blasingame Creek were calculated using the slope-area method.

All elevations are referenced from the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Mean Sea Level Datum of 1929. Elevation reference marks used in this study are shown and described on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed

to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 5 feet (Reference 7). In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). Small areas within the flood boundaries may lie above the flood elevations, and therefore may not be subject to flooding. Owing to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Blasingame Creek								
A	0.00	233	1,166	2.7	180.4	180.4	181.4	1.0
B	0.37	289	952	3.1	184.6	184.6	185.6	1.0
C	0.75	276	1,151	2.3	189.0	189.0	189.8	0.8
D	0.93	219	820	3.1	191.7	191.7	192.5	0.8
E	1.28	321	1,092	2.0	196.2	196.2	197.1	0.9
F	1.54	182	697	3.0	203.6	203.6	204.6	1.0
G	1.80	45	353	5.2	208.6	208.6	209.6	1.0
H	2.02	41	239	7.7	213.4	213.4	214.0	0.6
I	2.11	141	713	2.1	214.8	214.8	215.7	0.9
J	2.23	112	270	4.6	217.8	217.8	218.0	0.2
K	2.43	152	692	1.5	224.2	224.2	224.8	0.6
L	2.55	290/200[2]	2,011	0.5	229.7	229.7	229.9	0.2
M	2.68	131/70[2]	644	1.3	230.2	230.2	230.7	0.5

[1] Miles above western corporate limits.

[2] Total width/width within corporate limits.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

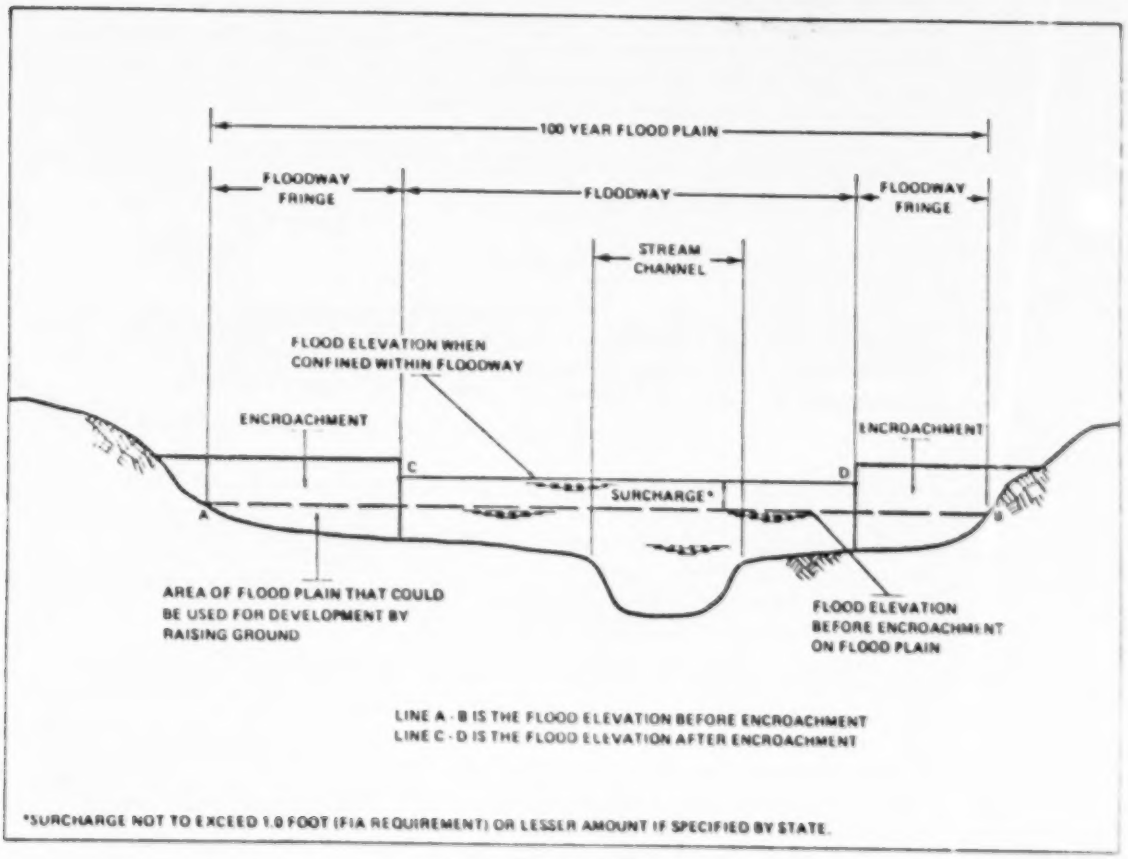
CITY OF HEMPSTEAD, TX

(WALLER CO.)

FLOODWAY DATA

BLASINGAME CREEK

1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FIA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC

Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each significant flooding sources affecting the City of Hempstead.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

One reach meeting the above criteria was required for Blasingame Creek. The location of the reach is shown on the Flood Profiles (Exhibit 1), and summarized in the Flood Insurance Zone Data Table (Table 3).

5.2 Flood Hazard Factors (FHFs)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of the City of Hempstead was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

Zone A2: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Hempstead is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

No other flood reports have been prepared for the City of Hempstead.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the office of the Federal Emergency Management Agency, Insurance and Mitigation Division, Federal Center, Denton, Texas 76201.

8.0 BIBLIOGRAPHY AND REFERENCES

1. Waller County Historical Survey Committee, "A History of Waller County, Texas", Waco, Texas, 1973.

2. Miscellaneous publications by the Hempstead Chamber of Commerce.

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3]
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Blasingame Creek Reach 1	0001	-1.0	-0.3	+0.5	010	A2	Varies

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT-SEE MAP

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF HEMPSTEAD, TX
(WALLER CO.)

FLOOD INSURANCE ZONE DATA

BLASINGAME CREEK

3. Houston-Galveston Area Council Technical Report, "Economic Base Analysis for the Houston-Galveston Region", Houston, Texas, 1978.

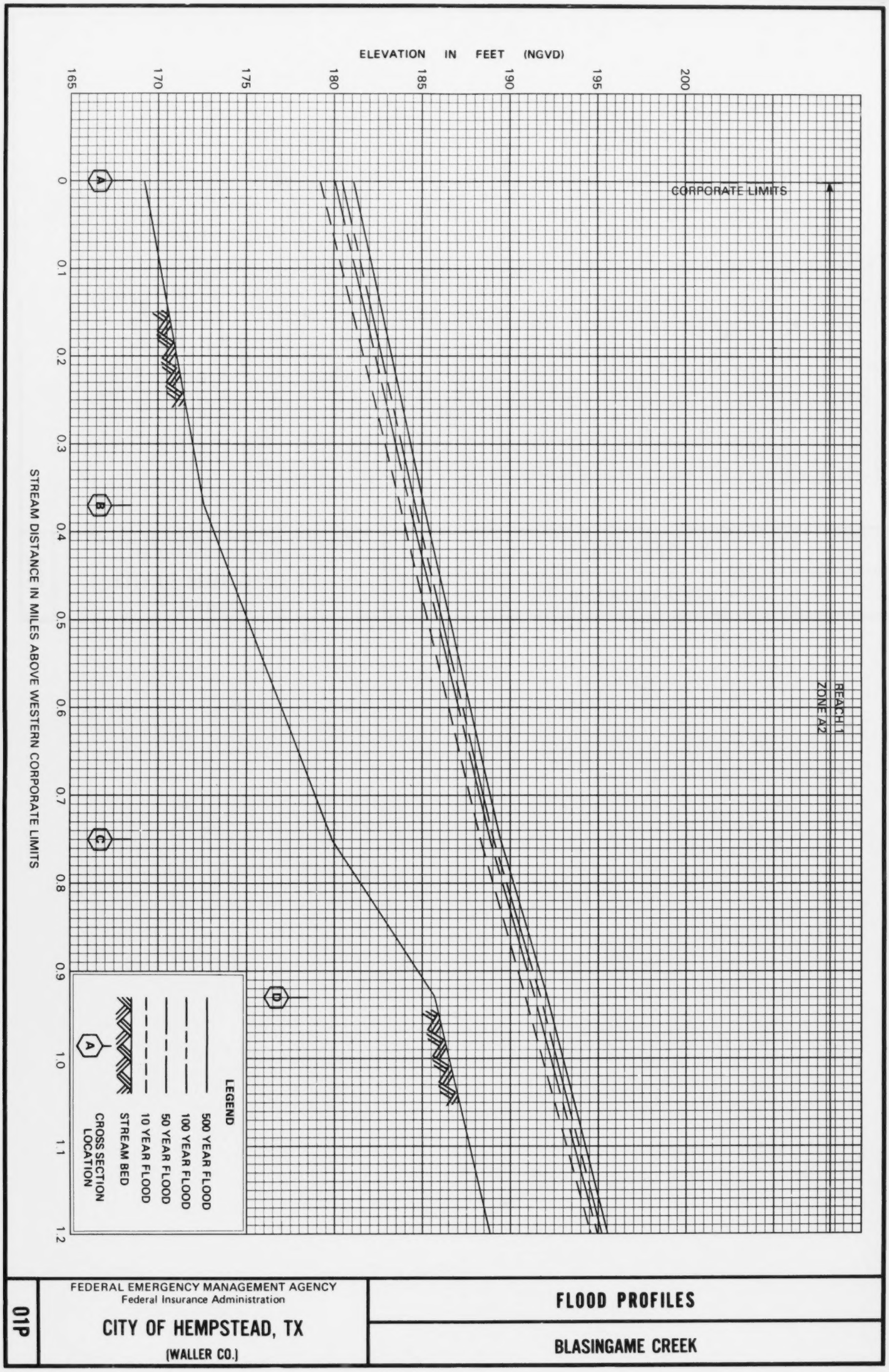
4. Houston-Galveston Area Council, "Regional Atlas", Houston, Texas, 1977.

5. Storm Sewers Delineated on Map by City Manager, City of Hempstead, August 1979.

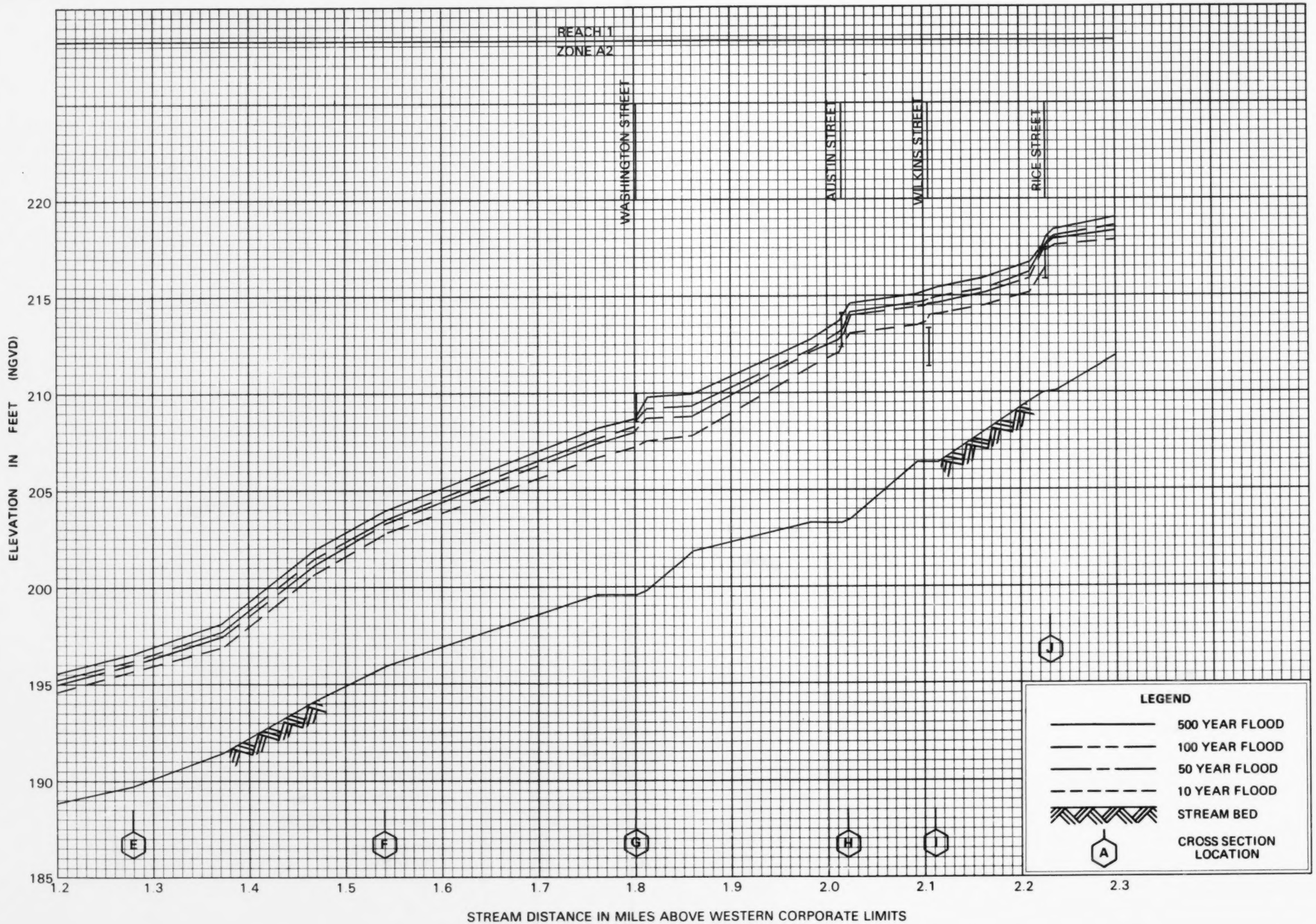
6. Thomas, W. O., and Corley, R. K., "Technique for Estimating Flood Discharge for Oklahoma Streams," USGS Water-Resources Investigations 77-54, Oklahoma City, Oklahoma, 1977.

7. U.S. Department of the Interior, Geological Survey, 7.5-Minute Series Topographic Maps: scale 1:24000, contour interval 10 feet, Hempstead, Texas (1961).

8. U.S. Army Corps of Engineers, Hydrologic Engineering Center, "HEC-2 Water-Surface Profiles, Generalized Computer Program," Davis, California, November 1976.



01P	FEDERAL EMERGENCY MANAGEMENT AGENCY Federal Insurance Administration **CITY OF HEMPSTEAD, TX** **(WALLER CO.)**	**FLOOD PROFILES** **BLASINGAME CREEK**



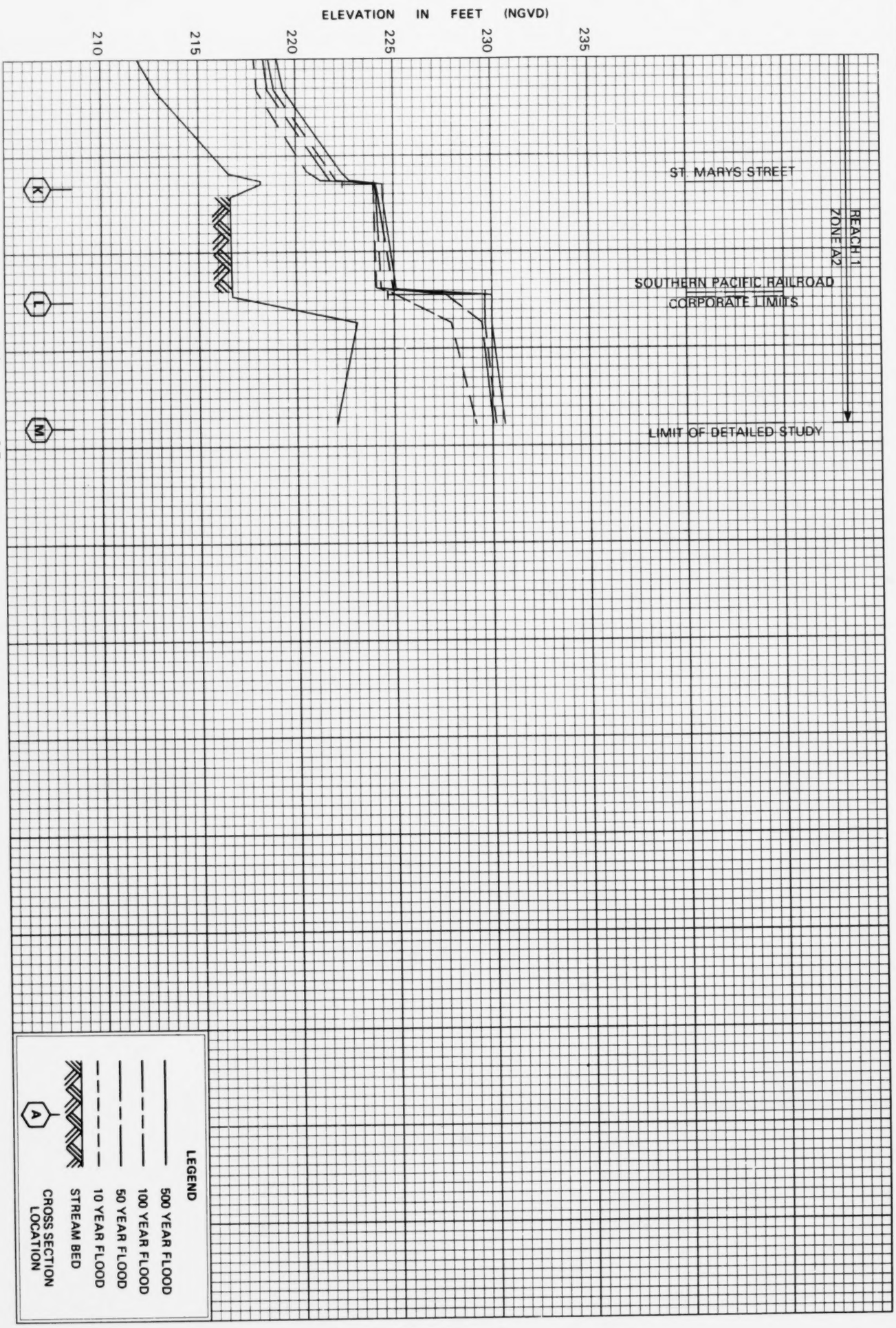
FLOOD PROFILES

BLASINGAME CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF HEMPSTEAD, TX
(WALLER CO.)

02P



03P

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration

CITY OF HEMPSTEAD, TX
(WALLER CO.)

FLOOD PROFILES

BLASINGAME CREEK